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Physical activity, physical fitness and disability in older persons.

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Summary

This dissertation focuses on the determinants of disability in older persons. In particular, the role of physical activity and physical fitness in the prevention of disability has been investigated. The dissertation includes a theoretical part as well as five empirical studies.

Chapter 1 deals with the theoretical work. Attention has been paid to aspects of aging, an integrated conceptual model has been developed, and measurement issues have been evaluated. Age differences and age changes have been described with knowledge of different fields of science: sports sciences with respect to physical fitness and physical activity; gerontology-related sciences with respect to morbidity and disability; and psycho-social sciences with respect to cognitive functioning and psychological functioning. It was shown that advanced age is associated with declines in several systems, but that old age also has its potentials with maintained quality of psychological functioning and possibilities to cope with limitations.

In this first chapter, an integrated conceptual model has been developed that describes the interrelationships between physical activity, physical fitness, disability and contextual factors. This conceptual model incorporates aspects of critically reviewed models and schemes originating from the different fields of science. From sports sciences, the "Bouchard model" was selected. This model predicts a positive relationship between physical activity and physical fitness. Physical activity has been operationalized to include sports activities and walking and bicycling for pleasure. Physical fitness has been considered as a multi-dimensional construct including several components: endurance, strength, flexibility, balance, reaction time and manual dexterity. From gerontology-related sciences the "International Classification of Impairments, Disabilities and Handicaps", the "Nagi Scheme", the "Disablement Process" of Verbrugge and Jette, and the "Heikkinen model" were selected. These models predict that reduced levels of physical fitness result from the aging process as well as disease. Furthermore, these models predict that reduced levels of physical fitness will result in higher levels of disability. Disability has been operationalized as experienced difficulty doing activities of daily living (ADL) with a physical component including basic ADL, instrumental ADL and vigorous ADL.

The relationship between physical activity and physical fitness has been

supported by arguments provided by exercise physiologists in their description of training principles as well as empirical evidence that physical activity can enhance physical fitness. The hypothesis that physical fitness is related to disability has been supported by Youngs "thresholds model" and some empirical evidence.

Since people differ in how they cope with reduced levels of physical fitness and health problems, it was expected that the three key concepts will relate to and interact with several psychological and environmental factors. From the psycho-social sciences, the "stress-appraisal-coping model" of Lazarus and Folkman was selected to provide insights which psycho-social determinants should be taken into account. From this model it was derived that cognitive functioning, psychological functioning, social support and socio-economic status may be important contextual factors.

Next to these aging-related topics, chapter 1 pays attention to measurement issues. These issues concern the relationship between self-report and performance-based measures of physical activity, physical fitness, and disability. Both methods do not necessarily yield the same results. Social network, social support, psychological functioning, cognitive functioning, and level of education are hypothesized to explain discrepancies between self-report and performance-based measures.

Chapter 2 uptill chapter 6 describe studies concerning data analysis of the Groningen Longitudinal Aging Study (GLAS). GLAS is a population-based study of the determinants of health-related quality of life in older persons, aged 57 years or older, in particular the determinants of physical and social disability and subjective well-being. The data are obtained from one of GLAS's substudies: a cross-sectional study on physical, sensory, and cognitive fitness in a representative selection ($n=624$) from the baseline participants of GLAS ($n=5279$). This selection included 274 men and 350 women aged 57 years or older.

Chapter 2 evaluated the validity of self-report measures of physical fitness as substitutes for performance-based tests. Therefore, self-reports and performance-based tests of physical fitness were compared. The performance-based tests included endurance, flexibility, strength, balance, manual dexterity, and reaction time. The self-report evaluation assessed selected individual subcomponents of fitness and used both peers and absolute standards as reference. The results showed that compared to performance-based tests, the self-report items were more strongly inter-related and they less effectively evaluated the different subdomains of

physical fitness. Corresponding performance-based tests and self-report items were weakly to moderately associated. All self-report items were related most strongly with the performance-based endurance test. Apparently, older people tend to estimate overall fitness, in which endurance plays an important part, rather than individual subcomponents of fitness. Therefore, the conclusion of this study was that the self-report measures have limited validity as predictors of performance-based physical fitness.

Chapter 3 examined the role of socio-demographic variables, cognitive and affective functioning, and personality in discrepancies between performance-based and self-report measures within three domains of physical limitations: motor functioning (physical fitness), hearing and vision. The strength of the association between self-reported and performance-based levels of physical limitations is moderate. Socio-demographic variables and levels of cognitive functioning explained some of the discrepancies between self-reported and performance-based vision. Within the domains of motor functioning and hearing, discrepancies were substantially influenced by affective functioning and personality. The discrepancies may reflect bias in perception or true variation in the effect of limitations on daily functioning. It was concluded that self-report and performance-based measures seem to complement each other in providing useful information about physical limitations.

Chapter 4 investigated physical fitness as a function of age and leisure time physical activity (LTPA). LTPA during the last twelve months was assessed through personal interviews. A wide range of physical fitness components was measured using performance-based tests. Physical fitness was associated with the interaction age by LTPA in only a few components, in a gender-specific way, with generally larger differences in fitness between active and less active persons with increasing age. All LTPA, including low intensity LTPA, is positively and age-independent associated with most physical fitness components. The conclusion of this study was that the importance of those LTPA typically participated in by the general population, lies not so much in the delaying of the motor aging process but rather in a general, age-independent, positive effect.

Chapter 5 investigated the relationship between separate components of physical fitness and disability. Subjects were restricted to persons aged 65 years or older (176 men and 233 women). Physical fitness was assessed with performance-based tests. Disability and potential confounders were assessed during face-to-face interviews. Independently of other fitness

components, walking endurance, grip strength, manual dexterity, and balance contributed significantly to the prediction of disability for both men and women. Flexibility of the hip and spine, flexibility of the shoulder, and reaction time were not independent predictors of disability for men or women. Physical fitness explained a greater percentage of variance in disability for women (31%-48%) than for men (14%-34%). Although depressive symptoms, cognitive functioning (men), number of chronic conditions (women), and age (women) explained additional variance in disability, these variables did not confound the relationship between physical fitness and disability. It was concluded that walking endurance, grip strength, and manual dexterity are important unique predictors of disability. Physical activity programs should be directed at these fitness components.

Chapter 6 investigated the association of physical activity, physical fitness, and psycho-social factors with disability. Subjects were restricted to persons 65 years or older. Physical activity, affective states, neuroticism, extroversion, self-efficacy, mastery, level of education, income, social support and disability were assessed during interviews. Physical fitness and cognitive functioning were assessed with performance-based tests. Analyses were performed using linear structural modeling techniques. Disability can be predicted effectively using a model that integrates knowledge of different fields of science. Physical activity is an important predictor of disability through the intermediary of physical fitness. In addition, there are also other independent predictors of disability, either directly or indirectly through physical fitness: cognitive functioning (indirectly), affective states (directly and indirectly), self-efficacy/mastery (directly and indirectly), and socio-economic status (directly for women and indirectly for men). Because physical activity and physical fitness are strong predictors of disability in older persons, it was concluded that participating in physical activity programs appears to be important, especially for older persons at risk of disability, who are characterized by lower levels of physical fitness, lower levels of cognitive functioning, lower perceptions of self-efficacy and mastery, more symptoms of depression and anxiety, and (for men) lower income.

Chapter 7 describes the general discussion with respect to theoretical issues, methodological issues and policy implications. The theoretical issues concern the problems related to the concepts of cognitive and psychological functioning, which can not only be considered as contextual factors but

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also in the main pathway, on the same level as physical fitness. An alternative model has been presented. One of the methodological issues concerns the representativeness of the sample, which might be a little positively biased. Furthermore, the disadvantages of the cross-sectional design have been discussed, and some remarks have been made by the measurement and data-analysis methods. The section concerning policy implications stresses the importance of physical activity for older persons, especially those at risk of developing disability. The prerequisites of physical activity programs have been discussed. Programs should aim to improve endurance, strength and coordination. Preconditions regarding the intensity of the activities should not be made in advance. Finally, this chapter provides some suggestions how to make this specific population at risk of developing disability to adopt a physically active lifestyle and how to adapt the contents of programs to the potentials of this population.